



Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

RAPID MODEL FABRICATION FOR RESPONSIVE AERODYNAMIC TESTING



Rapid prototyping (RP) is a robust, accurate, and affordable method to support aerospace research and development throughout Department of Defense organizations, industry, and academia involved in experimental ground testing. In the past, it took months to manufacture models for ground testing. Recent innovations in RP have made it possible to produce models within days. Rapid fabrication results in a faster and better response to the warfighter's needs by permitting concurrent study of new concepts in the wind tunnel and via computer simulation.



Air Force Research Laboratory
Wright-Patterson AFB OH

Accomplishment

Using the Air Vehicles Directorate's Subsonic Aerodynamic Research Laboratory, the Air Vehicles (VA) and Materials and Manufacturing (ML) Directorates collaborated to modify and test a model of the X-45A Unmanned Combat Air Vehicle fabricated by Johns Hopkins University/ Applied Physics Laboratory. Scientists used state-of-the-art RP methods to modify the model, and its testing improved understanding of the application of RP technology.

Background

The Air Vehicles Directorate conducts aerodynamics research at a variety of in-house test facilities at Wright-Patterson Air Force Base. The capabilities of these facilities range from very low-speed subsonic flows to very high-speed hypersonic flows. VA's history of aerodynamic research and development began in the 1920s when the United States Army Signal Corps established the Technical Services Office at McCook Field, Dayton, Ohio. Since that time, testing has evolved from being developmental in nature to supporting basic and applied research programs. RP will play an essential part in this role.

RP is a highly useful tool in today's experimental environment, leading to innovative technologies, significantly compressed design cycle times, and reduced costs. Current RP technologies include stereo lithography, selective laser sintering, laser engineered net-shaping, and fused deposition modeling. VA and ML collaborated to compile information on several of these techniques and their respective applicability to the suite of ground testing research facilities operated by VA.

The resulting information database matches research facility operating conditions with RP material capabilities and will provide the basis for other organizations to pursue and implement RP. Current wind tunnel model manufacturing techniques are slow, resulting in a lag between physical configurations tested by ground testing methods in the wind tunnels and configurations modeled with computational fluid dynamics (CFD). However, RP manufacturing techniques are maturing rapidly and enable the engineer to fabricate quickly a test article from the same digital model used for computer simulations done with CFD.

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (03-VA-08)

Air Vehicles
Emerging Technologies